IN THE CLAIMS

1. (Previously Presented) A method of clinical imaging comprising:

exciting water-exchangeable spins in oxygen-bearable molecules in a region-of-interest (ROI) having a change in oxygen status;

detecting proton transfer within the ROI from exchangeable protons within water; and

determining changes in oxygen levels across the ROI.

2. (Original) The method of claim 1 further comprising irradiating the ROI with exchangeable resonances and wherein the exchangeable resonances are within a resonance in a proton spectrum of one of deoxy-hemoglobin and deoxy-myoglobin.

3. (Original) The method of claim 2 further comprising selectively irradiating the ROI and distinguishing water signal changes within the ROI due to deoxy-hemoglobin and or deoxy-myoglobin from background MT effects.

4. (Previously Presented) The method of claim 3 wherein the proton spectrum is within at least one of a range of approximately 10 to 80 ppm.

5. (Original) The method of claim 1 wherein exciting includes irradiating the ROI such that spins of at least one of deoxy-hemoglobin and deoxy-myoglobin is excited.

6. (Original) The method of claim 1 further comprising assessing oxygen depletion within the ROI.

7. (Original) The method of claim 1 further comprising acquiring MR imaging data from the directly imageable molecules via proton transfer to enhance contrast between oxygen-rich and oxygen-depleted tissue in the ROI.

8. (Original) The method of claim 1 further comprising acquiring spectral data to perform a spectral analysis of oxygen content within the ROI.

PAGE 2/7 * RCVD AT 5/10/2005 1:36:54 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:12623762994 * DURATION (mm-ss):02-22

9. (Original) The method of claim 1 further comprising mapping the oxygen levels across the ROI.

10. (Original) A method of determining oxygenation of heme-proteins in vivo comprising:

applying radio frequency (RF) energy to an imaging subject to excite off-resonance spins of water-exchangeable molecules;

determining proton transfer from excited water-exchangeable molecules to non-excited molecules;

acquiring MR data from the non-excited molecules; and

determining oxygen content of the water-exchangeable molecules from the MR data.

11. (Original) The method of claim 10 further comprising determining a concentration of at least one of deoxy-hemoglobin and deoxy-myoglobin in the imaging subject.

12. (Original) The method of claim 10 further comprising determining a spatial distribution of oxygen debt across a data acquisition region.

13. (Original) The method of claim 10 further comprising determining proton transfer from the water-exchangeable molecules to water molecules.

14. (Original) The method of claim 10 wherein applying RF energy further comprises applying off-resonance RF pulses.

15. (Original) The method of claim 10 wherein applying RF energy further comprises applying a paramagnetic hyperfine-shifted exchangeable resonance RF pulse sequence to the imaging subject.

16. (Previously Presented) A magnetic resonance imaging (MRI) apparatus comprising:

an MRI system having a plurality of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field and an RF transceiver system and an RF switch

PAGE 3/7 * RCVD AT 5/10/2005 1:36:54 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:12623762994 * DURATION (mm-ss):02-22

controlled by a pulse module to transmit RF signals to an RF coil assembly to acquire MR images; and

a computer programmed to:

cause application of a pulse sequence to excite oxygen-bearable molecules within a ROI having a change in oxygenation;

acquire MR data from directly imageable molecules having been influenced by the oxygen-bearable molecules; and

reconstruct an image from the MR data to illustrate a change in oxygen debt across the ROI.

17. (Previously Presented) The MRI apparatus of claim 16 wherein the oxygen-bearable molecules include deoxy-heme-proteins.

18. (Original) The MRI apparatus of claim 17 wherein the deoxy-heme-proteins include at least one of deoxy-hemoglobin and deoxy-myoglobin.

19. (Previously Presented) The MRI apparatus of claim 16 wherein the oxygen-bearable molecules include proximal histidine NH.

20. (Original) The MRI apparatus of claim 16 wherein the computer is further programmed to determine oxygen concentration across the ROI.

21. (Original) The MRI apparatus of claim 16 wherein the computer is further programmed to map oxygenation levels across the ROI.

22. (Previously Presented) The MRI apparatus of claim 16 wherein the RF pulse sequence is configured to excite the oxygen-bearable molecules to a saturation such that a water transfer effect excites the directly imageable molecules.

23. (Original) The apparatus of claim 16 wherein the computer is further programmed to cause the ROI to be irradiated with multiple exchangeable resonance frequencies to enhance resolution of the image.

PAGE 4/7 * RCVD AT 5/10/2005 1:36:54 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:12623762994 * DURATION (mm-ss):02-22

24. (Original) The apparatus of claim 16 wherein the computer is further programmed to cause the ROI to be irradiated with multiple exchangeable resonance frequencies substantially simultaneously.

25. (Original) A system of oxygen content determination comprising:

means for exciting spins limited to targeted oxygen-carrier molecules;

means for determining a proton transfer from the targeted oxygen-carrier molecules to imageable molecules; and

means for determining oxygenation of the targeted oxygen-carrier molecules from a reconstructed image of the imageable molecules.

26. (Original) The system of claim 25 further comprising means for limiting spin excitation to proximal histidine NH molecules in an ROI.

27. (Original) The system of claim 25 further comprising means for displaying a spatial distribution of oxygen depletion across the ROI.

28. (Original) The system of claim 25 further comprising means for determining a concentration of at least one of deoxy-hemoglobin and deoxy-myoglobin in the ROI.

29. (Original) The system of claim 25 further comprising means for determining cancerous tissue presence in an ROI.

30. (Original) The system of claim 25 further comprising means for localizing oxygen depletion across an ROI.

PAGE 5/7 * RCVD AT 5/10/2005 1:36:54 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:12623762994 * DURATION (mm-ss):02-22